UNIVERSIDADE DE LISBOA
FACULDADE DE CIÊNCIAS
DEPARTAMENTO DE BIOLOGIA ANIMAL

The Neotropical otter in southeast Brazil: a socioecological approach

Ana Sofia Vieira Dias

Mestrado em Biologia da Conservação

Dissertação orientada por:

Doutor Nuno Miguel Pedroso

Professora Margarida Santos-Reis

2016

Dissertação de mestrado inserida no plano de pesquisa de Pós-Doutoramento de Nuno M. Pedroso, aprovado pela Fundação de Amparo à Pesquisa do Estado de São Paulo, Processo nº 2014/08601, investigador de pós-doutoramento do Centro de Energia Nuclear na Agricultura – CENA (Universidade de São Paulo, Piracicaba) e colaborador do Centre for Ecology, Evolution and Environmental Changes – cE3c (Faculdade de Ciências da Universidade de Lisboa).

Agradecimentos

Em primeiro lugar, como não poderia deixar de ser, quero agradecer profundamente ao meu orientador, Doutor Nuno Miguel Pedroso por todo o apoio que me proporcionou ao longo desta que foi a maior e melhor experiência da minha vida profissional até ao momento. O caminho foi longo e com um ou outro percalço, mas creio que o resultado final é extremamente positivo e isso deve-se em grande parte a todos os ensinamentos que me foram dados. Obrigada por tudo Nuno, mas principalmente pela paciência e pela disponibilidade.

Quero também deixar um enorme obrigada à minha orientadora, Professora Margarida Santos-Reis, por todas as sugestões e conselhos. Desde o questionário, até ao documento final, as suas contribuições foram sempre muito úteis e melhoraram muito todo este trabalho. Obrigado pelo seu apoio ao longo de toda a tese.

Ao Professor Luciano M. Verdade, que atuou como um guia durante todo o trabalho no Brasil, ajudando com os primeiros contatos com os habitantes locais, sugerindo locais de entrevistas e interpretações dos resultados obtidos, deixo um "joínha, joínha"!

Aos meus "colaboradores" e amigos que ajudaram na escolha dos entrevistados, Professor Victor Zannetti, Nain Almeida e Neli Rodrigues, deixo um grande "VALEU!!". Fica também aqui um muito obrigada a todos os participantes deste estudo, que foram sempre solícitos, simpáticos e cooperativos durante as entrevistas.

Agradeço todo o apoio logístico da Estação Ecológica de Angatuba/ Instituto Florestal, na pessoa da Bióloga Bárbara Prado, que sempre colaborou o máximo possível, ajudando com questões de alojamento, fornecimento de material e divulgação do trabalho.

Agradeço à Amanda Moretto e à Ana Rita Martins pela ajuda na revisão do questionário e ajuda com as questões linguísticas.

Agradeço particularmente a três das minhas amigas pelo especial apoio durante toda a tese. À minha lady Didles, que é uma das melhores prendas que levo comigo do meu percurso universitário. Você encontra-se no topo! À minha Ju, que está comigo desde o 9.º ano e nunca me abandonou, por mais que estivéssemos separadas. E à Ana C., amizade que se revelou na maior surpresa deste mestrado.

Obrigada também à minha Madre Rita “kiki” e aos meus pequenos rebentos, Manel e Mariana, por serem a minha segunda família e pelo interesse que sempre tiveram no que se passava durante as minhas viagens.

Aos meus amigos e colegas de mestrado, Mohamoedas, Chiquinho, Robério e Emanuéu, agradeço todos os momentos de risota, de descontração e de desabafo ao longo deste stress que foi a tese! Aos meus restantes amigos de há vários anos, Aninhas, Nuninho, Gi, Pedro “pandinha”, Martim e Xoto, obrigada pelo apoio e preocupação que sempre mostraram, principalmente ao longo deste ano da tese.

Obrigada também aos meus “papais do Brasil”, a Fran e o Fábio, pela companhia e por me ajudarem a conhecer melhor a região de Piracicaba. A vossa amizade fez o Brasil ficar muito mais bonito! Viva a Ex-turma do Pensionato!

E por último, mas não menos importante (antes pelo contrário), agradeço aos meus pais, por todo o apoio que me deram ao longo de todo o meu percurso académico e principalmente durante o meu trabalho na tese. Fico feliz por vos deixar orgulhosos e por ver a felicidade estampada nos vossos rostos!

Fico muito feliz por saber que todos vocês estão a assistir e fazem de alguma forma parte deste momento de viragem na minha vida.

Resumo

Desde há vários milhares de anos que se reconhece a existência de problemas entre as populações humanas e as espécies silvestres, alguns devido a sobre-exploração por parte do Homem, outros devido a competição por alguns recursos biológicos chave. Estes dois fatores em regra geram conflitos e atitudes negativas por parte das populações humanas, face ao impacto negativo que as espécies silvestres têm nas atividades humanas, como a agricultura ou piscicultura. Em casos extremos, as espécies podem ser alvo de perseguição por parte do Homem, levando ao seu declínio e por vezes extinção local em retaliação pelos danos causados. Estes problemas são particularmente relevantes em regiões com elevada incidência de espécies potencialmente problemáticas (e.g. predadores), sendo os Trópicos um exemplo adequado.

O Sudeste brasileiro é a região mais povoada e desenvolvida do Brasil. Como consequência, apresenta graves problemas ambientais, incluindo desflorestação em larga escala dos seus principais biomas (Mata Atlântica e Cerrado), considerados *hotspots* de biodiversidade. Esta desflorestação atinge igualmente a vegetação ripária associada aos ambientes aquáticos (e.g. ribeiras, rios ou estuários), considerada um dos habitats mais sensíveis a alterações antrópicas, levando à consequente perda de locais de refúgio, reprodução e alimentação para diversas espécies. Os mamíferos semiaquáticos são um dos grupos animais mais sensíveis a estas alterações, pois a sua persistência depende significativamente da existência desta vegetação durante o seu ciclo de vida. As lontras, pelas suas características bio-ecológicas, são frequentemente utilizadas em estudos que visam a resposta de espécies semiaquáticas a pressões antrópicas.

A lontra Neotropical, *Lontra longicaudis* (Olfers, 1818), uma das duas espécies de lontras existentes no Brasil, é considerada uma das menos conhecidas a nível mundial. A espécie está presente numa variedade de corpos de água, incluindo barragens e açudes. O recente aumento de informação disponível sobre a espécie levou a uma mudança no seu estatuto de ameaça, de "Informação Insuficiente" para "Quase Ameaçada" desde o final de 2015 devido, entre outros fatores, a incertezas sobre os efeitos das inúmeras ameaças antrópicas, mantendo-se, no entanto, um elevado desconhecimento sobre o efetivo populacional, área de ocupação, efeito cumulativo de ameaças ou interação com as populações humanas. Contudo existe a perceção de competição por peixe, em rios e em tanques de pisciculturas, e relatos de perseguição a lontras por parte de piscicultores e pescadores em algumas áreas do Brasil.

Assim, estudos sobre a avaliação dos conflitos entre a lontra e as populações humanas e a sua distribuição regional, são considerados vitais para a conservação efetiva da espécie.

O presente estudo foi realizado na bacia do rio Guareí e na sua envolvência, no estado de São Paulo, Brasil. Esta área está inserida nos municípios de Guareí e Angatuba, originalmente correspondentes ao bioma Cerrado. É uma área propícia à agricultura devido em grande parte, à sua extensa rede hidrográfica. A população local é composta principalmente por agricultores, gestores/encarregados de fazendas e pescadores de pequena escala, com uma elevada percentagem de pescadores desportivos e ocasionais.

Este estudo teve por objetivos: 1 - Avaliar o conhecimento da população local sobre a ecologia da lontra Neotropical e sua perceção da espécie; 2 - Identificar a relação entre o conhecimento e as atitudes da população local em relação à lontra; 3 - Identificar fatores de ameaça para a espécie na área de estudo, incluindo potencial para o conflito com o Homem; e 4 - Obter informações sobre a distribuição da espécie na área da bacia do rio Guareí e sua envolvência.

Os resultados esperados eram: (1) a existência de um potencial para conflito entre a comunidade local e a lontra, devido à competição pelos mesmos recursos, bem como com proprietários/utilizadores de pequenas lagoas/açudes; (2) níveis de conhecimento variáveis na comunidade local sobre a ecologia da lontra, com vantagem para os pescadores locais; e (3) uma correlação positiva entre o conhecimento e as atitudes em relação à espécie. Adicionalmente, (4) era esperada uma identificação dos fatores sociais, como localização geográfica, idade ou escolaridade, que poderão estar a influenciar as atitudes e conhecimento das pessoas face à espécie.

Para tal foram realizadas 44 entrevistas à população, entre outubro de 2015 e março de 2016, guiadas por um questionário presencial semiestruturado. A maioria dos entrevistados pertencia ao setor primário (agricultores, pescadores e gestores de fazendas) e secundário (trabalhadores da construção civil). O questionário incluiu perguntas sobre: i) o perfil do entrevistado, ii) a ecologia e contacto com a lontra; iii) atitudes para com a espécie, iv) e ainda perguntas sobre o habitat, qualidade da água e seu uso pela população local.

Primeiramente foram criadas diversas variáveis com base na informação sobre o perfil do entrevistado: Grupo (pescador/não pescador); Uso de açudes (usa/não usa); Localização; Classe de idade e Escolaridade. Seguidamente foram criados dois índices: o Índice de Conhecimentos com base em perguntas sobre a ecologia da espécie e o Índice de Atitudes, com base numa escala de Likert construída para avaliar as atitudes das pessoas em relação à lontra. A fim de avaliar se as perguntas de cada um dos índices eram ou não independentes

entre si, recorreu-se a Análises de Componentes Principais (PCA). Sempre que se verificou correlação entre perguntas, aplicou-se o coeficiente alfa de Chronbach para avaliar a consistência interna das perguntas que compunham o índice. Foram também elaborados Escalonamentos Multidimensionais (NMDS) para perceber quais as potenciais relações entre as variáveis e os índices criados, antes da aplicação dos testes estatísticos. Finalmente, todas as perguntas do questionário individualmente e os dois índices criados foram comparados com cada uma das cinco variáveis através de testes de Mann-Whitney ou Kruskal-Wallis, dependendo da tipologia de variável.

Complementarmente, entre os meses de outubro de 2015 e junho de 2016, foram realizadas campanhas de campo para validação dos locais de avistamento de lontras referidos nas entrevistas, permitindo construir um mapa de distribuição da espécie na área de estudo.

Com esta abordagem, verificou-se que os entrevistados são capazes de identificar a espécie com base na sua morfologia, uma vez que a descreveram corretamente. No geral a população apresenta um elevado conhecimento sobre a ecologia da lontra, mas por outro lado mostrou desconhecer o estatuto de ameaça da espécie, tanto a nível internacional como regional (estado de São Paulo). Quando analisado por localização, o conhecimento revelou-se significativamente menor na área da cidade de Guareí (uma das cinco localizações amostradas), facto que pode ser justificado pela menor concentração de pescadores na região, pois esta encontra-se mais próxima da nascente do rio Guareí, que é uma zona mais pedregosa e por isso menos adequada à prática de pesca.

No que respeita as atitudes, estas são no geral positivas, não tendo sido detetado nenhum conflito relevante com a espécie na região, de acordo com a atual natureza da coexistência dos habitantes com a lontra. No entanto, os utilizadores de açudes apresentaram atitudes mais negativas quando comparados com não-utilizadores, o que pode ser justificado pelo facto de estes reservatórios poderem ser usados como locais de exploração de peixe em pequena escala pelos seus proprietários, que muitas vezes aumentam os *stocks* de peixe nos açudes com este objetivo.

O mapa de distribuição da espécie obtido reúne informação sobre 68 avistamentos ao longo dos últimos 20 anos, apesar da sua maioria estar concentrada nos últimos 2 anos. Este revelou que a lontra se encontra presente em toda a área de estudo e que apresenta uma presença regular ao longo do tempo, pois existem avistamentos temporalmente espaçados nos mesmos locais. Os resultados do estudo indicam que o método das entrevistas a populações locais é

muito útil na obtenção de informação acerca da distribuição de espécies com hábitos solitários e de difícil observação como a lontra Neotropical.

Com as entrevistas e as campanhas de campo realizadas, foi igualmente possível identificar potenciais ameaças ambientais para a lontra: (1) poluição dos rios por descarga de efluentes sem tratamento ou com tratamento deficiente, ameaça mais mencionada pelos entrevistados e mais observada durante as campanhas de campo; (2) desflorestação, com especial destruição da vegetação ripícola por conversão dessas áreas em campos agrícolas; (3) redução dos *stocks* de peixe, atualmente ainda sem grande expressão na região mas situação que no futuro pode vir a agravar-se se a qualidade da água continuar a declinar; e (4) perda de conetividade do habitat, consequente por exemplo do desaparecimento dos açudes, o que pode levar a uma maior fragmentação do habitat para a lontra.

Um maior investimento em ações de divulgação e de educação ambiental, como aquelas já implementadas no decurso deste projeto contribuirá para a conservação da espécie na área de estudo. Mais ações de esclarecimento junto de pescadores para reduzir equívocos como a quantidade e as espécies de peixe ingeridas pela espécie, ou junto de estudantes para despertar o seu interesse para questões ambientais e de conservação, devem ser implementadas. Adicionalmente, a monitorização da espécie em áreas com: (1) maior potencial para conflito, (2) elevada intervenção humana e (3) consideradas ótimas para a ocorrência da espécie, é necessária a fim de antecipar a necessidade de promover medidas de conservação.

Palavras-chave: *Lontra longicaudis*, conhecimento local, distribuição, questionários, conflito

Summary

The Neotropical otter, *Lontra longicaudis*, is viewed as a potential competitor with humans in activities related to fisheries and aquaculture. Nevertheless, there are few studies concerning their possible interaction. With this study, we aimed at gathering information on the relation between local communities and the Neotropical otter as well as identifying environmental threats to the species and assessing the species distribution at Guareí river basin and its surroundings in Central-South São Paulo (Brazil). We conducted forty-four semi-structured interviews, between November 2015 and March 2016, that included questions about the interviewees, otter ecology, attitude toward the species and on the habitat and water condition and its use by local people. Field surveys were also conducted to confirm information on otter occurrence in some of the areas with sighting records. Results showed that people using small ponds have a more negative attitude toward the otter, since they are used for fishing, with otters seen as competitors. Local population has a good knowledge of the species diet, habitat and activity period but most ignored its protection status; this indicates that knowledge is acquired through interactions with the species during labor or recreational activities with science-based knowledge not available or not transferred to public. Apparently, coexistence between local inhabitants and the otter is not problematic and no major conflict emerged. These are contrasting results with other areas of Brazil or Europe, where otter is a conflictual species and suffers persecution. This probably results from the fact that local fishing communities are not professional and fish stocks are still high. Otter is widespread in the study area, with information on sightings dating from 20 years ago up to the present, with most of the records in the last two years. Water pollution and destruction of the riparian vegetation for conversion to crop fields are major local anthropic pressures. More investment in education programs and species monitoring in risky areas for conflict might be decisive for local conservation efforts.

Keywords: *Lontra longicaudis*, local knowledge, distribution, questionnaires, conflicts

Table of Contents

1. Introduction

1.1. Theoretical Framework

For several thousands of years, man has induced major changes and pressures on natural habitats, either by converting them into anthropogenic landscapes (agricultural, urbanized) (Diamond, 2001, 2005) or by overexploiting resources provided by Nature (Micheli et al., 2001). In such context, conflicts between humans and predators arose, primarily because of competition for limited and shared resources (Akpona et al., 2015; Graham et al., 2005), and these are the product of socio-economic pressures and landscape management.

An example of a conflict-generator group of predators is the carnivore mammal community. These animals are globally characterized by having vast territories, low population densities and low intrinsic growth rate and for that are more susceptible to anthropic induced changes (Crooks, 2002). Carnivore mammals have also a great variety of feeding habits, that include all other animal groups, and this is the main reason why they are especially targeted as conflict species (Woodroffe, 2000). Episodes of competition between them and human populations have been reported around the world and are generally related to relevant economic activities, such as life-stocking (Berger, 2006) or fishing (Kranz and Toman, 2004). The coexistence between humans and predators has been reported for millennia, but the frequency of conflicts has grown in recent decades, mainly due to the exponential increase in human populations and the consequent expansion of human activities (Treves and Karanth, 2003; Woodroffe, 2000). These conflicts become more serious and intense in highly biodiverse regions, such as the Tropical region, that concentrates the largest proportion of global biodiversity, concerning both animal and plant taxa, encompassing several biodiversity hotspots (Brooks et al., 2006).

Brazil is the second country in the world with the largest diversity of mammals (Vié et al., 2009), with about 650 native species (Cheida et al., 2006), of which the vast majority depends on forest native habitats that are currently being threatened. The Southeast is the most populated and developed region of Brazil. Consequently, it presents strong environmental problems, including a massive deforestation of its major original biomes, the Atlantic Forest and the “Cerrado” (Verdade et al., 2011), from core lands till the margins of aquatic environments. Thus, in this region, ecosystem modifications are intense and conservation concerns are high.

Aquatic environments (e.g. streams, rivers, estuaries) are among the most sensitive to anthropic induced changes and are currently under increasing pressure due to water pollution and loss of riparian vegetation. Riparian habitats are critical landscape elements for the conservation of several carnivore species, providing shelter and food (e.g. Matos et al., 2008). In spite of their recognized importance as ecosystem service providers (e.g., flood regulators), they are frequently considered to have small or no direct economic value, leading to substantial loss and degradation (Tockner and Stanford, 2002). Semi-aquatic mammal species, are constrained by the fact that in spite of spending most of their activity time in water, due to their terrestrial movements, they are also influenced by margin conditions and the surrounding landscape matrix (e.g. production forests, agricultural areas, livestock production) (Verdade et al., 2011). Habitat humanization near riparian areas is therefore a matter of concern since semi-aquatic mammals depend on these for terrestrial mobility and refuge.

Among semi-aquatic mammals, otters are used in ecological studies that aim the response of semi-aquatic species to human pressures (Alarcon and Simões-Lopes, 2003; Pedroso et al., 2014). Otters are also a group species that is on the spotlight of human related conflicts. Studies conducted, mainly in Europe, but also in other continents, like Africa (Akpona et al., 2015) show that the relation between otters and people is often complicated, due to predation in fish farms, that can cause losses in commercial fish stocks (e.g., Václavíková et al., 2011). For example, Kranz (2000) reported that in areas where fish farming is an important industry, fish farmers perceive Eurasian otters (*Lutra lutra*, Linnaeus, 1758) as a threat, this being the case of central Europe, like in Czech Republic and Austria, but also southern countries such as Portugal (Freitas et al., 2007). For this reason, there are also some records of otter poisoning and illegal killing by fish farmers, mainly in eastern Europe (Kloskowski, 2005, 2011; Poledníková et al., 2010).

However, negative public perceptions toward otters do not only apply to direct conflicting situations such as with fish farmers. For instance, Bath and Farmer (2000) found that more than one-quarter of teenagers questioned in Northern Ireland were afraid to swim in rivers where otters were present. Interestingly, in several studies concerning attitudes towards animals or their conservation, knowledge levels were correlated with attitudes, showing that the greater the knowledge, the more positive were attitudes toward otters (Bath and Farmer, 2000) or towards nature conservation in general (Rosalino and Rosalino, 2012).

Public perceptions and potential for conflict can also be influenced by aspects such as age, education and location. Pont et al. (2015), in a study on fishermen's perceptions on the South American sea lions (*Otaria flavescens*) in a marine protected area in southern Brazil, found that

older fishermen had a stronger sense of the damage caused by sea lions. Moreover, fishermen with a higher educational level had a less severe perception of damage caused by the species. In a review of published literature aimed at identifying the most investigated topics related to commercial fishers' attitudes towards Marine Protected Areas (Pita et al., 2011), divergent attitudes and perceptions were observed amongst fishers from different locations and cultural backgrounds and within different groups of fishers from the same location. However, common trends in fishers' attitudes were also observed irrespectively of geographical locations and cultural contexts (Pita et al., 2011).

In South America, some studies also report conflicts between fishermen and giant otters, *Pteronura brasiliensis* (Gmelin, 1788), because this species is more known due to their conspicuousness and highly territorial behavior (Lima et al., 2014; Michalski et al., 2012; Rosas-Ribeiro et al., 2012). But few publications address the interaction between men and the Neotropical otter, *Lontra longicaudis* (Olfers, 1818), namely in Brazil (Barbieri et al., 2012; De Castro et al., 2014) where the species co-exist with the giant otter. These are focused in fishery-based communities, where otters are seen as problematic, due to: 1) depredation in fishery and aquaculture stocks (Barbieri et al., 2012); and 2) gillnets damage, a common reported situation (Alarcon and Simões-Lopes, 2004).

Being so, the Neotropical otter was chosen as model for this study. This species weights between 10 and 15 kg, with the males about 20% larger than the females. Being a semiaquatic animal, the otter is perfectly adapted to swimming, having a fusiform body and interdigital membranes, long and thick tail and short coat; this coat is greyish brown dorsally and slightly lighter ventrally (Larivière, 1999).

The Neotropical otter has a wide distribution range (from Mexico to northern Argentina), occupying a variety of water bodies from sea level up to 4,000 m altitude: rivers, lakes, marshes, coastal areas and wetlands (Rheingantz and Trinca, 2015), including artificial reservoirs (Eisenberg and Redford, 1999). In Brazil, the species occurs almost everywhere, provided that water bodies show favorable conditions (rivers, streams, lakes and coastal areas with freshwater availability and with plenty of potential sites for burrows and resting sites), but is absent from a wide area in the semi-arid region in the north-eastern. Considered an opportunistic predator, the Neotropical otter prefers preys with low leakage capacity (Pardini, 1998; Quadros and Monteiro-Filho, 2001), feeding mostly on fish, but also consuming crustaceans, mollusks, amphibians and insects, depending on the time of year (Carvalho-Junior et al., 2010, 2013; Rheingantz et al., 2011).

The reproduction occurs mainly in the dry season, but in certain areas it can occur throughout the all year. Gestation lasts about 56 days and otters can have up to five pups, but the average is two or three (Larivière, 1999). With solitary habits, except during the breeding season, it is mostly a diurnal species, being more active at the beginning and the end of the day, but becoming nocturnal in areas with high human presence (Rheingantz et al., 2016). The Neotropical otter is a territorial species, leaving scent marks (feces and mucus) to communicate their presence to conspecifics and to coordinate sexual activity. For refuge otters can use almost any cavity available on the riverbank, as well as digging shallow holes or open spaces in the underbrush (Pardini and Trajano, 1999).

In spite of its vast range the species is Considered to be “Near Threatened”, both by the International Union for Conservation of Nature (IUCN) and by the Brazilian government in the state of São Paulo (Rodrigues et al., 2013). However, information is lacking about population size, area of occupancy, number of mature animals, the cumulative effect of threats (Rheingantz and Trinca, 2015), genetic diversity and levels of population connectivity, and even less is known about interactions with man (Barbieri et al., 2012). Threats include contamination and pollution of aquatic environments (Gallo-Reynoso, 1997), deforestation, agricultural activities, mining, construction of dams (Chehebar, 1990; Gallo, 1986; González and Utrera, 2004; Melendres, 1978), poaching (Chehebar, 1991; González and Utrera, 2004; IBAMA, 2001) and the increase of road kills due to habitat fragmentation (Duplaix, 2004). Studies concerning a more comprehensive understanding on distribution patterns and demographic parameters, such as population size and dispersal patterns (Rheingantz and Trinca, 2015), are therefore important for the conservation of the Neotropical otter.

In the state of São Paulo, small farmers combine fishing (both in rivers and in ponds) with agricultural activities. Many properties have natural or artificial small ponds usually used for water supply (for agriculture and cattle) but are also stocked with fish. Interactions between fishermen or people exerting other aquatic activities and the environment are important to the ecosystem management, due to the economic dependence of natural resources (Begossi et al., 2004). Being so, local communities that use aquatic resources can contribute with information about native species occurrence and status (Barbieri et al., 2012; De Castro et al., 2014). Local knowledge should be recognized as an important source of information for species management (Barbieri et al., 2012; Zappes et al., 2009). It becomes especially important when dealing with species with incomplete ecological information or facing drivers of conflict, that can be especially relevant when the resources involved have high economic

value and the species under concern are legally protected (Thirgood et al., 2000), such as the case of the Neotropical otter.

With this study, we aimed to gather information on the relation between local communities, in a region of the São Paulo state in Brazil, and the Neotropical otter, and obtain additional ecological information on the species.

1.2. Study Aims

Specific objectives of this study were to:

1 - Evaluate the knowledge and perceptions of the local population about the Neotropical otter;

2 - Assess the relationship between knowledge and attitudes of the local population towards the species;

3 - Identify possible threat factors for the species in the study area, including potential for conflicts with humans; and

4 - Obtain information about the distribution of the species in the area of the Guareí river basin and its surroundings.

We expected: (1) an existing conflict between local fishermen and the otter that may lead to competition for the same resources (fish both in rivers and small ponds); (2) a greater knowledge on otter ecology by local fishermen compared to non-fishermen; and (3) a positive association between knowledge and attitudes (more knowledge leading to more positive attitudes towards the species). We further expect (4) that social factors such as geographic location, age or education of the interviewees are influencing the attitudes and level of knowledge about the species.

With this approach, we aimed to ascertain potential environmental threats to the local population of Neotropical otters and evaluate the need for conservation measures, as well as to provide a regional map of the species distribution.

2. Methods

The study was conducted mostly in the “Guareí” and “Angatuba” municipalities, in the state of São Paulo in Brazil. The main river in these municipalities is Guareí river, inserted in the Alto Paranapanema river basin. It flows from 23°20'54.1"S / 48°04'58.5"W (river source) to 23°28'38.3"S / 48°36'58.5"W (river mouth). With an extension of approximately 78km has its source in the “Guareí” municipality (Secretaria do Meio Ambiente / Instituto Florestal, 2009), crosses through the “Angatuba” municipality and flows into the Paranapanema river (Henry, 2012) (Figure 1).

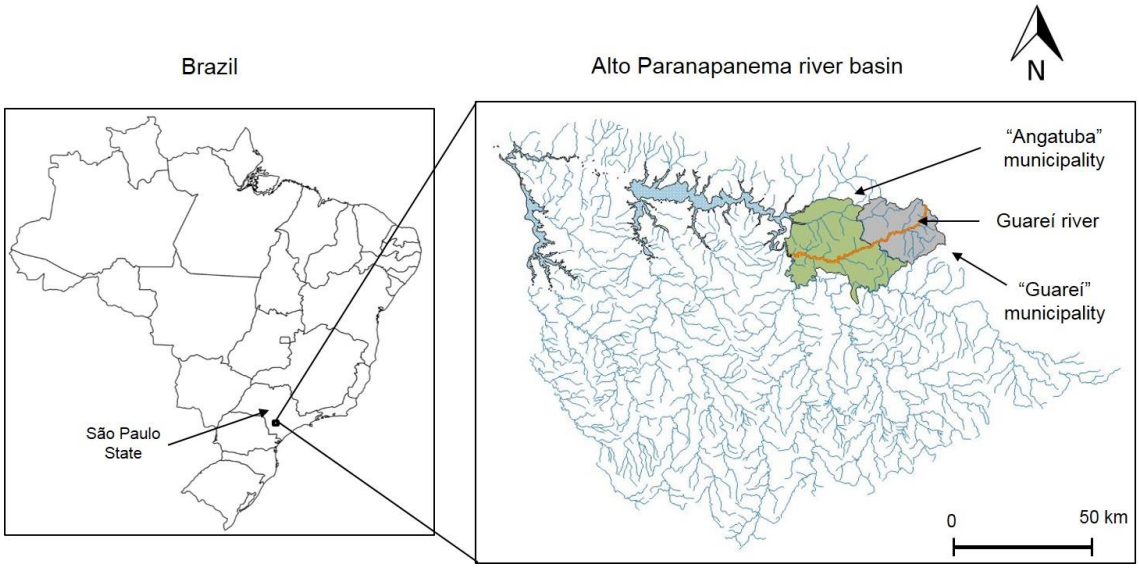

Figure 1 - Study area in the state of São Paulo, Brazil, Alto Paranapanema river basin, Angatuba and Guareí municipalities and Guareí river.

The area is characterized by a sub-tropical climate (Cwa type according to Köppen climate classification; Peel et al., 2007), with average temperatures of 22°C in the warmest month (March) and 17°C in the coldest one (June). This region is highly suitable for agricultural production, due to its vast hydrographical network, represented by river courses with large (e.g., Paranapanema river), average (e.g., Itapetininga and Guareí rivers) and small (e.g., Santo Inácio and Jacu) water flows (Henry, 2012). Hundreds of farmsteads linked to the agricultural activity and recreation (“chácaras”) have emerged in riverine locations, including the Guareí river.

The study was based on: i) field interviews based on a questionnaire designed to assess local knowledge and attitudes towards the Neotropical otter, and ii) field surveys to confirm otter presence at locations given by interviewees.

2.1. Questionnaire survey

2.1.1. Questionnaire design

The questionnaire (Annex I), constructed as a guide for the interviews, was divided in four parts, each with a specific set of questions. Part I aimed the characterization of the interviewee (e.g. gender, age, education); Part II assessed knowledge about otters and its ecology, Part III assessed attitudes toward the species; and Part IV assessed the knowledge on otter habitat and water quality at the river and small ponds and its use by local people. Part IV was partly based on a previous questionnaire intended to report the history "Angatuba" municipality (Henry, 2012).

The questionnaire was semi-structured in design, being mostly composed by multiple choice questions (yes or no, or pre-established answers) and a few open questions, where interviewees were able to give details about their activities (Huntington, 2000). Peoples' attitudes toward the otter were measured by the Likert-type scale (Likert, 1932) and scored from 1 (strongly disagree) to 5 (strongly agree). A higher score indicates a more positive or negative attitude towards the otter. When statements represented a negative attitude, the scores were reversed for the analysis. To decrease the chance of having blank answers, the great majority of the questions included the option "I do not know".

A pre-test was performed with experts and non-experts to confirm the relevance and comprehension of the questions, leading to small wording adjustments before field application.

2.1.2. Sampling method and interviews

Forty-four questionnaires were applied between October 2015 and March 2016. These were made through face-to-face interviews to a single individual and always by the same interviewer, in order to avoid sampling biases.

To ensure a higher likelihood that interviewees know about or had contact with otters they were selected on the basis of past or current activities connected to aquatic environments (e.g. fishing in rivers, river transportation, use of small ponds). Selection of interviewees was done with the help of local people (e.g. high school teacher, residents, representatives from state departments), in order to decrease chance of rejection and gain trust. These acted as guides and mediators. When necessary, a snow-ball method (Bailey, 1982) was used at the end

of an interview, with the interviewee indicating others inhabitants suitable to respond the questionnaire.

The estimated time of the interview was around 15 to 20 minute but interviewees were allowed to make additional comments, complementing and contextualizing the answers to the questionnaire (Hill and Hill, 2000).

A description of the animal was asked at the beginning of the interview. After that, a photograph of the otter was presented, to confirm whether the species indicated by the interviewee was indeed the Neotropical otter.

In order to maximize diversity of data collection, five areas were chosen for the interviews application: 1) “Bairro da Ponte”, a small fishing village near the Guareí river mouth and its confluence with the Parapanema river; 2) “Salto” village, a small town bathed by the Paranapanema river, although located outside the main study area (in “Campina do Monte Alegre” municipality), was also considered since fishing is an important activity; 3) “Angatuba” city and its closest neighborhoods, located approximately in the middle of the Guareí river extension; 4) two contiguous farms (“Arca” and “Três Lagoas”) currently devoted to commercial Eucalyptus production although maintain areas devoted to conservation, according to the Brazilian law, and Angatuba’s Ecological Station (henceforth EEcA, based on its Portuguese acronym “Estação Ecológica de Angatuba”), characterized by a native vegetation of semideciduous seasonal forest and “Cerrado”; all three properties are outside urban perimeter with an important number of small ponds; and 5) “Guareí” city and its surroundings, a larger urban area that corresponds to the beginning of the Guareí river (Figure 2).

These study areas have different characteristics (e.g. size, type of exploitation, number of small ponds, percentage of urban vs non-urban land-cover, percentage of native vs non-native vegetation, level of fishing activity) and a wide geographical distribution along the basin, ensuring high diversity of interviewees.

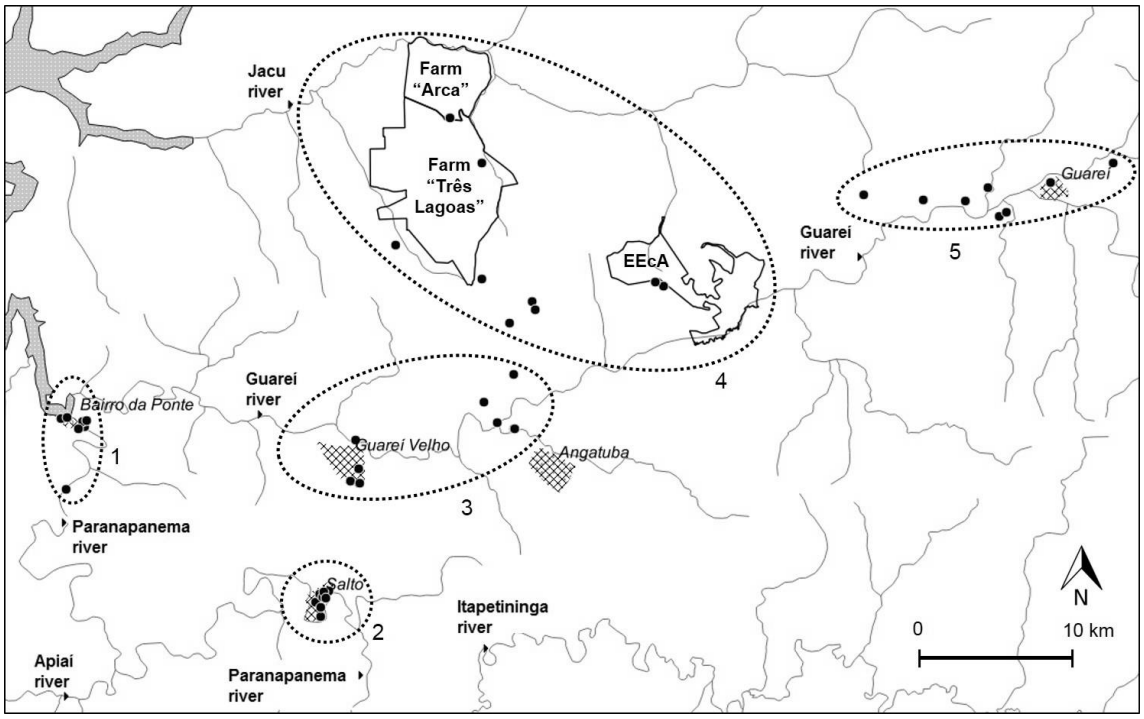

Figure 2 - Location of areas where interviews (black circles; n= 44) were conducted (1 - Bairro da Ponte village, n=9; 2 - Salto village, n=9; 3 - Angatuba city, n=8; 4 - farms "Arca" and "Três Lagoas" and Angatuba's Ecological Station (EEcA), n=10; 5 Guareí city and its surroundings, n=8). Main rivers and localities in the study area (Angatuba and Guareí cities and Bairro da Ponte, Salto and Guareí Velho villages).

2.1.3. Statistical analysis

Univariate (Mann–Whitney and Kruskall-Wallis tests) and multivariate methods (Principal Component Analysis and Nonmetric Multidimensional Scaling) were used in order to better recognize potential relations between variables. The information gathered in Part I of the questionnaire (interviewee profile) was used to create variables categories (Table 1). Regarding age, the Sturges rule was applied. This is a widespread tool to simplify variables that have a wide variety of values (Scott, 2009). Its application resulted in the creation of six classes; but once the last class was under represented, classes 5 and 6 were merged. This categorization allowed the use of age as a factor in the statistical analysis, both as a continuous and ordinal variable.

Table 1 - Variables selected for statistical analysis

Variable	Category
Group	Fisherman
	Non-fisherman
Small Ponds	User
	Non-user
Education	No education
	Elementary school
	High school
	College degree
Age class	Class 1 (17 to 27 years)
	Class 2 (28 to 38 years)
	Class 3 (39 to 49 years)
	Class 4 (50 to 60 years)
	Class 5 (> 61 years)
Age	Absolute value
Location	"Bairro da Ponte" village
	"Salto" village
	"Angatuba's" surroundings
	Farms/EEcA
	"Guareí" surroundings

In this study, we tried to balance the categories, mainly those we could control best like group, age and location.

Two indexes were created to evaluate the knowledge and attitudes of interviewees about the otter. The first, the Knowledge index (KI) was based on the five questions about the ecology of the Neotropical otter. A right answer was coded with "1" and a wrong or "I do not know" answer was coded with "0". This index varied between 0 and 5. The Attitude Index (AI) resulted from the interviewee opinions about given statements used in the Likert scale. These statements addressed a variety of actions people could take to conserve the otter and its habitat. Neutral opinions were coded with "0", positive opinions with "1" or "2" depending on the degree of agreement, and negative opinions with "-1" or "-2". Index value could vary between -14 and 14.

A Pearson correlation was applied between age (absolute value) or age classes and the two indexes. The correlation was stronger with the age class, so was opted to use that variable in the analysis.

Data normality and homoscedasticity were tested with Shapiro-Wilk test and Levene's test respectively, but as assumptions failed non-parametric tests were used for statistical analysis.

A Principal Component Analysis (PCA) was applied to explore the structure of the interview for each index and the relation between the questions and the interviewees' answers. It was also applied to see if the questions used in the KI and the statements used in the AI were correlated, contributing to the same result, or if they were independent with no relation between them. In the first case the Cronbach's alpha coefficient may be applied as a measure of internal consistency of the sets of questions/statements used in the indexes. Its value gives us a lower bound estimate of their reliability, indicating if they are positively related. Cronbach's alpha value varies between 0 and 1, but the reliability is considered satisfactory when alpha is at least 0.70 (Nunnally, 1978).

A Nonmetric Multidimensional Scaling (NMDS) ordination was performed (Hyman and Sierra, 2010), using the scores of the KI and AI for each interviewee respondent. NMDS constructs a two-dimensional ordination with arbitrary axes in order to achieve the best representation of the relationships among interviewees based on a similarity matrix. The similarity matrix was designed using the Euclidean Distance for constructing the similarity matrix. A 2D bubble configuration plot was produced for both indexes. The robustness of the ordination is indicated by the stress value in the output diagram: <0.2 gives a potentially useful two-dimensional representation; <0.1 corresponds to a good representation and <0.05 reflects an excellent representation (Clarke and Warwick, 2001). Prior to NMDS application, data were transformed to improve normality, using a normalization by the standard deviation (Legendre and Legendre, 1998). Relationships between indexes and variables were explored by projecting the Pearson correlations between the NMDS axes and each variable on the ordination diagram.

Mann–Whitney U-tests – henceforth M-W – were applied, to test if there was a significant difference in the KI, AI and in frequencies of the answers given by fishermen and non-fishermen. The same applied to users and non-users of small ponds. Kruskall-Wallis H-tests - henceforth K-W - were used to test if there was a significant difference in the KI, and AI and in frequencies of the answers given per age classes, education levels and geographic locations. Kendall's Coefficient of Concordance was used to test if there was a correlation between the two indexes as these provide discrete data (Noether, 1981).

There was no effect of "non-response", because all people responded to all answers.

Most of the statistical analyses were performed with the STATISTICA software, version 13 (Dell Inc, 2015) and IBM SPSS version 22 (IBM, 2013). Data analysis on NMDS was conducted using the software Primer 6.0 (Clarke and Gorley, 2006).

2.2. Field surveys

Field surveys in aquatic environments (streams, rivers, ponds) to search for otter signs of presence (dens, scats, footprints, claw markings) were conducted, by boat and foot transects, between October 2015 and June 2016 to validate the use of questionnaires as source of otter occurrence. A minimum of 30% of areas with reported sighting records was defined as appropriate. If after 1km of survey no sign was found the transect was considered negative for otter. In order to map Neotropical otter sightings in the study area, during questionnaires interviewees were asked to report whether, where and when they had seen an otter, for the last time and in the past. It was specifically asked to locate all sightings to get the maximum information regarding otter distribution. Data collated was as much precise as possible regarding location and date of sighting. This information was translated to a species occurrence map using QGIS version 2.10.1-Pisa (Quantum GIS Development Team, 2016).

3. Results

3.1. Interviewees profile

Of the 44 interviewees, 90.9% (n=40) were men. The average age was 49 years (SD = ± 14.9). Most of the interviewees (68.1%) attended elementary school meaning that the focus group had basic education; only 6.8% did not have any education. The distribution of interviewees per each category is given in Table 2.

Table 2 - Number of interviewees per category

Variable	Category	Number of interviewees
Group	Fisherman	26
	Non-fisherman	18
Small Ponds	Users	23
	Non-users	21
Education	No education	3
	Elementary school	30
	High school	7
	College degree	4
Age class	Class 1 (17 to 27 years)	6
	Class 2 (28 to 38 years)	5
	Class 3 (39 to 49 years)	10
	Class 4 (50 to 60 years)	13
	Class 5 (> 61 years)	10
Location	"Bairro da Ponte" village	9
	"Salto" village	9
	"Angatuba's" surroundings	8
	Farms/EEcA	10
	"Guareí" surroundings	8

Interviewees included people from the primary sector (farmers, fishermen, farm managers) (n= 18), civil construction, industry and small businesses workers (n= 8), teachers (n=2), students (n= 3), retired people (n=9), housewives (n=2), a biologist and a bus driver.

3.2. Knowledge and attitudes toward otters

Regarding the knowledge of the population about the Neotropical otter, all the interviewees knew the species, and all but one had already seen it. Otters had been seen in the surroundings of the place of the interview by 52.3% of interviewees and 59.1% have sighted the species elsewhere and were able to provide other locations for the species occurrence.

Regarding the regularity of otter sightings, 56.8 % of interviewees stated they saw the animal at time lapses of more than one month, 6.8% said they saw the species monthly, 11.4% weekly and 22.7% more than once per week.

When analyzing results by location and group, the inhabitants of the Farms/EEcA region saw otters less frequently than those in other regions ($H=20.25$, $p<0.05$), and fishermen more often than non-fishermen ($U=20.3$, $p<0.05$). The otter population trend was classified as "increasing" by 47.7% of interviewees, with fishermen being the group that reported that tendency more often ($U=103$, $p<0.05$), as opposed to those who think that the otter is decreasing (22.7%) or stable (15.9%).

In general, interviewees answered correctly to the questions about otter ecology, with an average knowledge score (KI) of 3.2. Almost all interviewees (97.7%) knew the main food resource in the otter's diet (fish), with 13.6% also referring birds as otters' prey. Concerning the habitat, 77.2% knew that the otter lives in riverbanks but when this question was analyzed by location, "Guareí" interviewees presented less knowledge of the species habitat, with 62.5% wrong and "I do not know" answers. On the other hand, "Salto" village inhabitants presented the most accurate knowledge about species habitat, with 100% correct answers ($H= 9.4$, $p<0.05$). On species activity period, 84.0% reported the otter as more active during the day, mainly in the dawn and twilight.

Most interviewees did not know that the Neotropical otter is currently protected by the Brazilian State government, mainly the inhabitants of "Guareí", where no one referred the otter as a protected species ($H=10.5$, $p<0.05$). Moreover, when asked if the drought affected the otter in some way, only 29.5% of the interviewees stated that it negatively affect otters, the other referring to it as beneficial, because it makes the prey (fish) easier to catch, or neutral. Fishermen think more often that drought is beneficial to otters than non-fishermen ($U=153$, $p<0.05$).

Regarding the possible conflict between the human population and the otter, most interviewees stated that otters had never interfered with their activities (72.7%) nor their neighbors' activities (65.9%). But, when the answers are analyzed by location, "Bairro da Ponte" reported more incidents with otters when compared with the other four locations, both considering personal ($H=15.8$, $p<0.05$) and neighbors ($H=12.3$, $p<0.05$) damage. Fishermen also reported being more affected by the otters ($U=170$, $p<0.05$), as well as neighbors ($U=143$, $p<0.05$). Lastly, people with age varying between 39 and 49 years (class 3) reported more damage caused by otters ($H=11.8$, $p<0.05$).

The average attitude score (AI) towards otter was 9.6, in a maximum of ±14 points, indicating a positive attitude towards the otter.

3.3. Otter habitat and threat factors

Regarding otter habitat, prey and possible threat factors, 54.5% of the interviewees said that the water quality is decreasing (particularly those of age class 2 - $H=7.8$, $p<0.05$) and 65.9% stated that the amount of fish available in rivers or small ponds is declining. When asked if new species of fish are appearing in the river, 47.7% of interviewees answered yes, referring to Peacock bass (*Cichla* sp), Piranha (*Pygocentrus nattereri* - Kner, 1858) and Tilapia (*Coptodon rendalli* - Boulenger, 1897) as the main invasive species. "Bairro da Ponte" location ($H=10.0$, $p<0.05$) and fishermen group ($U=308$, $p<0.05$) were the ones thinking more often that the amount of fish species is increasing.

Users of small pounds more often consider that the amount of wild animals is increasing by those reservoirs ($U=607.5$, $p<0.05$).

Regarding water availability, 84.1% of interviewees confirmed the region has been suffering from drought in the past years. Concerning the riparian vegetation, there was no concordance among interviewees, with 36.4% saying the vegetation is declining in area while 43.2% referred to it as increasing. But when analyzed per location, differences between locations emerged. Inhabitants of "Salto" village and "Angatuba's" surroundings state more often that the vegetation is decreasing, while those from "Bairro da Ponte", the Farms/EEcA and "Guarei" region, refer an increase in area. Lastly, when asked if the politicians were concerned about the river water quality, 63.6% of the interviewed people answered "No", with the older age class being the category that answered more often "I do not know" ($H=10.9$, $p<0.05$).

The PCA showed the KI questions are independent, being all distributed in different directions of the graph and representing different dimensions of the knowledge about the otter (Figure 3).

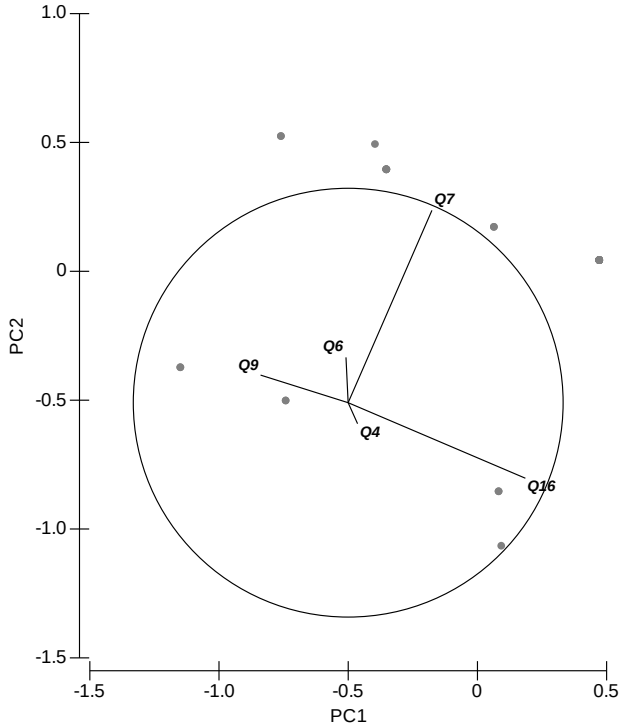

Figure 3 – PCA applied to the Knowledge Index questions

When applied to the AI statements, the PCA shows they are in some way correlated, contributing in general to the same result. Although, with the analysis of the Figure 4, the statements do not express all the same dimension.

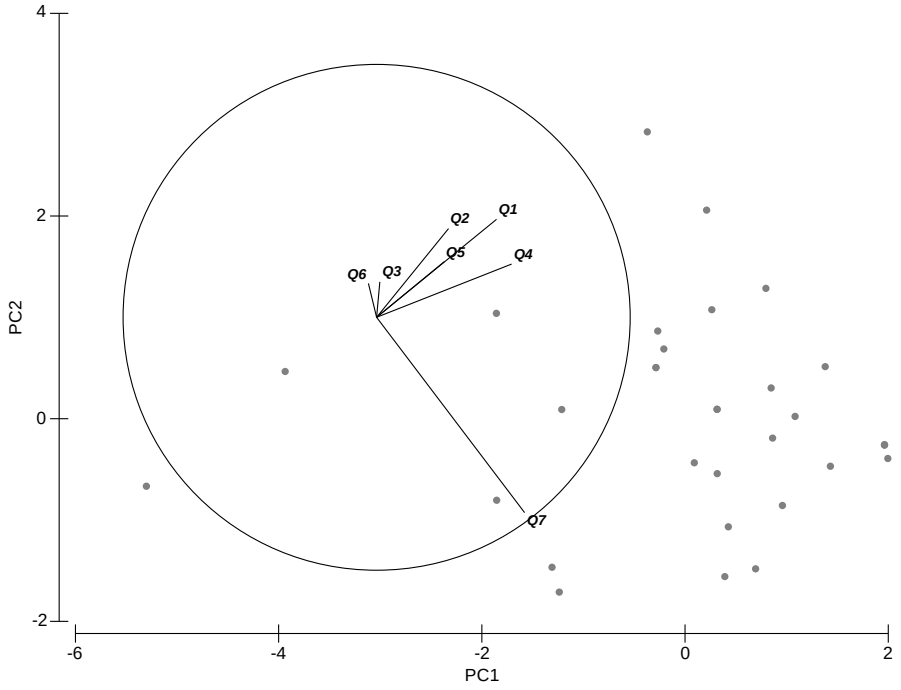

Figure 4 – PCA applied to the Attitude Index statements

Due to the level of congruence among results Cronbach's alpha coefficient was only applied to the AI to validate the cohesion of its statements, showing a satisfactory reliability with a good cohesion between the statements that composed the index (α = 0.73). Although the elimination of some statements could increase the Cronbach's alpha value, it was very low and therefore all them were retained in the AI. Although the Cronbach's alpha, was not applied to the KI, this fact doesn't invalidate the application of the index, just shows the relation between the questions, that in this last case, could be all used independently.

The NMDS revealed trends in the relation between variables and the indexes. Concerning the KI output, the smaller values are mainly located in the "Guareí" surroundings axis, and larger values are located in the Farms/EEcA axis, revealing a possible correlation between KI and these locations (Figure 5). Regarding the AI output, the greater values of this index are located in the education axis while the smaller values are in the small ponds axis, indicating a positive and a negative relation with AI respectively (Figure 6).

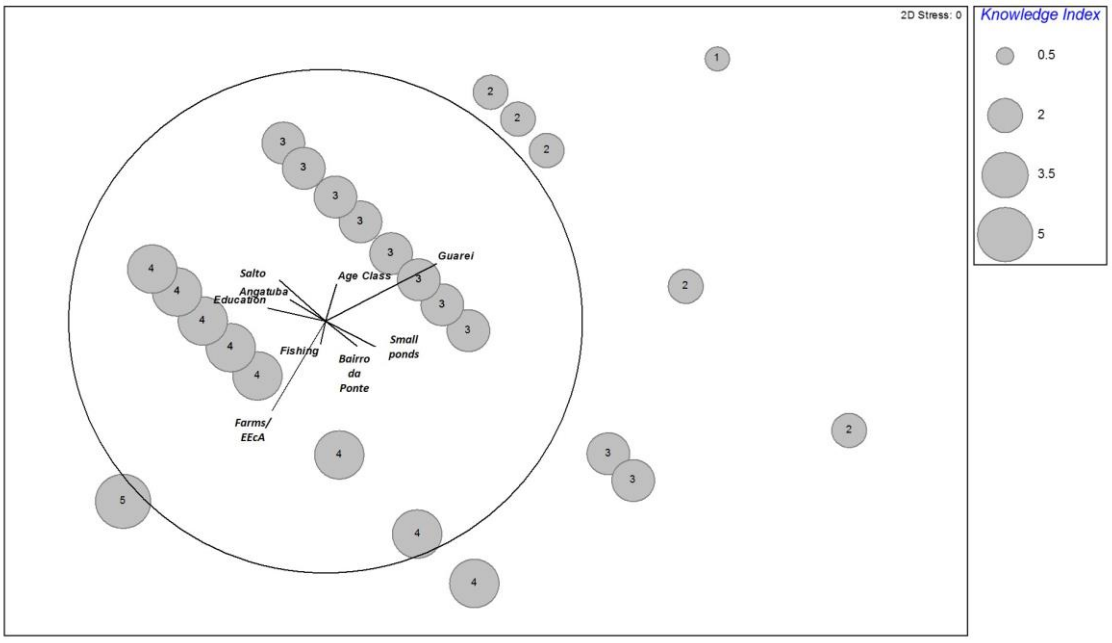

Figure 5 - NMDS between Knowledge Index values and chosen variables

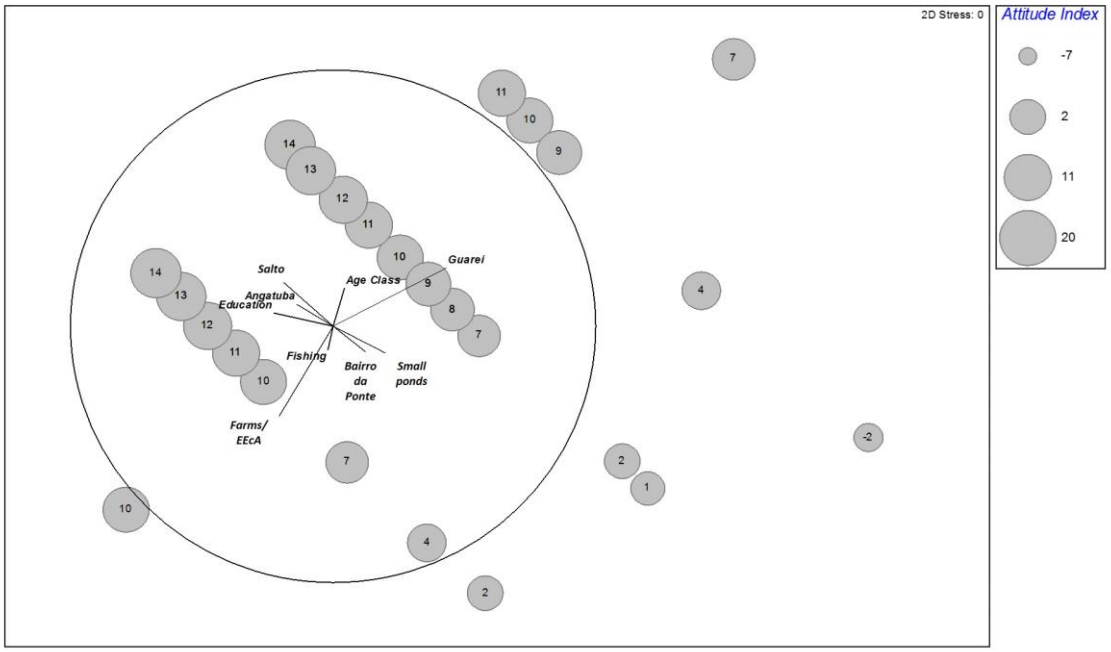

Figure 6 - NMDS between Attitude Index values and chosen variables

The stress value in both NMDS was zero, revealing that the representations with two axes are excellent, not being necessary the addiction of more axis, what could difficult the interpretation.

Some of the NMDS trends reveled to be statistically true when M-W and K-W test were applied. Users of small ponds have more negative attitudes toward the otter ($U= 148$, $p < 0.05$) (Figure 7).

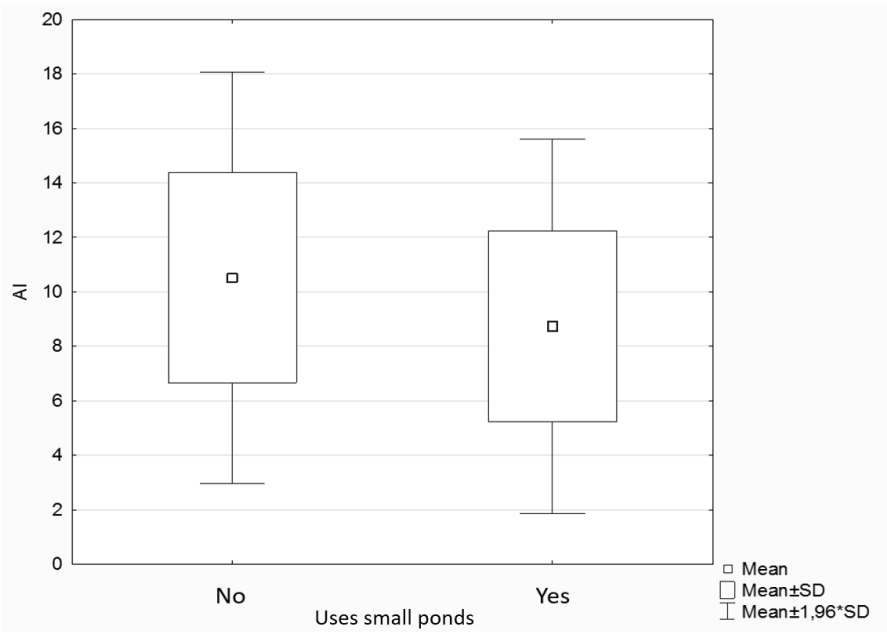

Figure 7 - Box plot of the differences in the AI of users and non-users of small ponds.

The analysis of the otter knowledge in the different locations showed significant differences in the "Guareí" surroundings. In this town, the knowledge is lower when compared to the other four locations ($H= 12.3$, $p < 0.05$) (Figure 8).

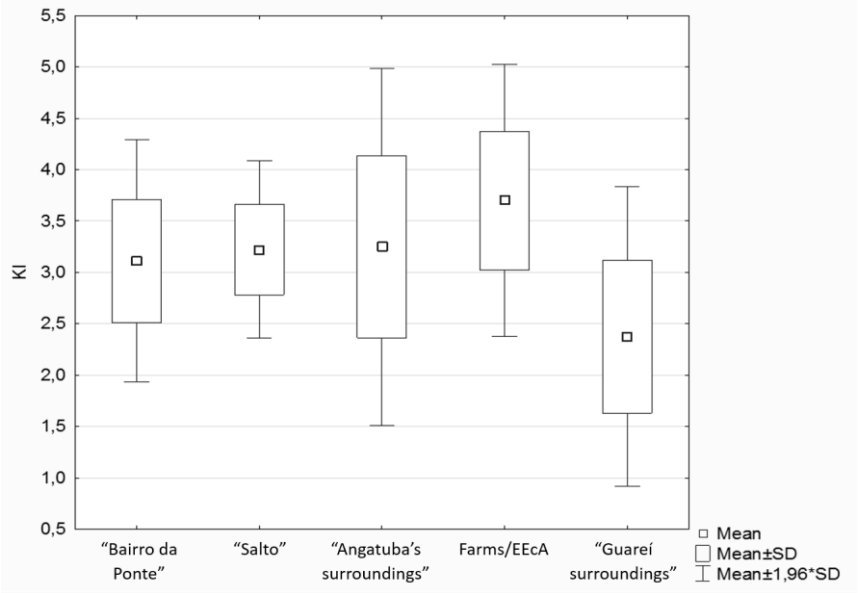

Figure 8 - Box plot of the differences in the KI between locations

No correlation was detected between the KI and the AI.

3.4. Otter Distribution

The information obtained on otter sightings (n= 68) allowed to map otter distribution revealing a more or less generalized occurrence of the species in the study area (Figure 9).

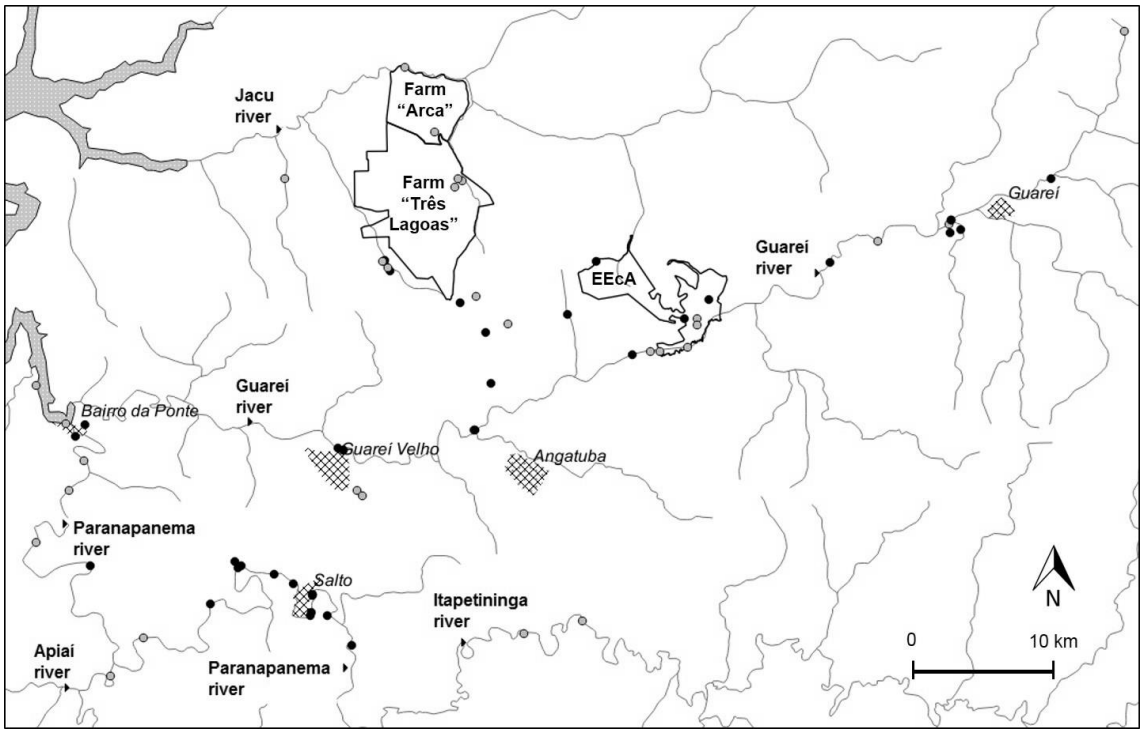

Figure 9 - Distribution of the Neotropical otter's sightings (black circles: < 2 years; grey circles: > 2 years) in the study area.

The 68 sightings corresponded to 57 different otter locations, since there are some sightings that occurred at the same location. The otter is widely distributed alongside the Guareí river basin, being also present in Paranapanema and Itapetininga rivers. Otter also occur in the "Arca" and "Três Lagoas" farms, mainly in the main streams that cross those properties. In the EEcA, otter sightings were registered in places that have water permanently, namely the stretch of Guareí river and the larger pound inserted in the property. There were also reports of the species in seasonal streams.

These sightings date from 20 years ago up to the present, although the majority (53%) report to the last two years. In this study, field surveys allowed to confirm otter presence in 20% of the locations given by the interviewees, out of 35% surveyed sighting areas.

4. Discussion

The present study allowed the collection of relevant data about the Neotropical otter conflict assessment, the identification of other possible threat factors to the species and local otter distribution, contributing to an increased knowledge about the otter in the Guareí river basin and its surroundings. This is a relevant area for the species conservation in the state of São Paulo, in Brazil.

The interviewees gave a correct description of the otter based on its morphological characteristics, confirming they are able to identify the species. This fact generates confidence in the data collected on otters during the interviews. Globally, the population has a good ecological knowledge of the species, especially of its diet, habitat and activity period. Two factors can contribute to the present widespread knowledge about the Neotropical otter. The first is the regularity of otter sightings in some areas, and the second the common and widespread practice of information transmission from the oldest to the younger generations that occurred in the region (Lisboa, 2008). However, this knowledge was unevenly distributed per locations with inhabitants of "Guareí" surroundings being less aware of the species. This can be justified with the fact that this region is located upstream the Guareí river, being less adequate to fishing activities (Henry, 2012). Additionally, the Guareí river is considered a medium flow river not easy to navigate and consequently less used for fishing activities when compared with the Paranapanema river. On the other hand, in "Angatuba" municipality, historical records prove that education was more widespread and complete when compared to neighboring municipalities, an aspect that can justify why the knowledge is locally greater (Lisboa, 2008). Notwithstanding, most interviewees did not know that the otter is a protected species (especially, again, in "Guareí" surroundings), indicating that knowledge is acquired through direct or indirect interactions with the species during labor or recreational activities and there is a deficiency of science-based information available to or assimilated by the public.

Not well understood by the interviewees, especially fishermen, was the effect of drought to otters. They associate lower water levels to easiness in catching fish, not considering drought severity. In extreme situations, otters may be forced to move in search for other hunting grounds or face loss and fragmentation of habitat. This was observed during our field campaigns, when several ponds and small streams dried due to the extreme drought felted in 2014-2015. Extreme events, such as droughts and floods, are becoming recurrent and unpredictable (e.g. there was a severe flood in the 2016 dry season) and will have impact on otter feeding and reproduction.

The inhabitants of the Farms/EEcA area reported less otter sightings when compared to other locations, that can be explained by distance to main river courses and lower water-related activities. When comparing fishermen with non-fishermen, the first see more often the species, an expected result since they have an higher likelihood to be in contact with otters, due to their fishing activity. Although a subjective assessment, since fishermen reported more often that the otter population is increasing, we could assume that this is probably a good indicator of a possible thrive of the otter population in the region for the last years.

Regarding different perceptions on riparian vegetation cover among locations, these can be explained by the changes in land use along the Guareí river basin. In "Angatuba's" surroundings there is an increase of crop areas (Henry, 2012), causing more deforestation, namely along river sides, despite the conservative Brazilian environmental law (Metzger et al., 2010).

Regarding the unbalanced sex-ratio of interviewees, this is common in communities with fishing habits (e.g. in a study that included two fishing communities in southern Brazil, of the 36 fishermen interviewed, only one was a woman - Barbieri et al., 2012). It was difficult to obtain a balanced age class distribution, because: on one hand some of the locations the representativeness of the younger age groups was very low, namely in Bairro da Ponte and Guareí surroundings; and furthermore the majority of the fishermen has around 40 to 60 years. Age class five (> 61 years) was the one that presented less knowledge about environmental measures promoted by politicians, a fact that can be related to less access of elderly people to information and also a higher discredit caused by a large number of unfulfilled promises by the local government. All age class two (28 to 38 years) interviewees think the water quality is decreasing with no clear reason.

The obtained results suggest that coexistence of inhabitants and the otter is not problematic, indicating that there is no major conflict. Only some interviewees, especially inhabitants from "Bairro da Ponte" and fishermen, reported few negative incidences involving the otter, like preying on gillnets and damaging fishing gear, a fact already mentioned in other regions of Brazil, like the states of Santa Catarina (Alarcon and Simões-Lopes, 2004) and Rio Grande do Sul (Barbieri et al., 2012). Regarding age class, 3 (39 to 49 years of age) was the one that reported more damage by otters, and this may be explained because these people are more active fishermen.

The perception of otters by interviewees was globally positive, because a large number of them did not explored fish and, when they did, their motivations were not economic but

mainly for their own consumption. This was already reported in the Czech Republic with the Eurasian otter (Václavíková et al., 2011). In our study area, interviewees generally agreed that spotting otters in their natural environment is a highly attractive event, mentioning the species as an appealing animal that deserves protection. These are contrasting results with the state of Rio Grande do Sul, where two fishing communities see the otter as the major source of loss to their income (Barbieri et al., 2012). Our results are similar to those obtained in a fishing community in the south of the state of São Paulo (Caiçara) where, though the majority of the interviewees refer the otter as one of the major sources of fish loss, they understand that competition between humans and animals is inevitable and see the otter as a friendly companion (De Castro et al., 2014).

Other studies also identified that the fishermen perception on the conflicts were directly related to otter depredation on fish in fishing gear and not to predation of fish species with no commercial interest (Alarcon and Simões-Lopes, 2004; Marques, 2001). In a previous study at the Paranapanema river (included in the study area), it was observed that the main species of fish preyed by the otter were those with low leaking capacity that live near the margins of the river and therefore are not the main catch by fishermen (Tavares et al., *in press*). However, they also reported fishing-net damage related to otters.

The average of both knowledge and attitude indexes reveals again that, in general, the population is knowledgeable about the species and do not perceive otters as a major problem to their activities. The significant differences in the KI between "Guareí" and the other locations are most probably related to the already referred environmental constrains, having less condition for the practice of fishing. Still regarding locations and although there was no significant relation, a positive trend was observed between KI and Farms/EEcA location, that can be related with the historical effort to provide valuable and efficient educations to rural areas (Lisboa, 2008).

Expectation was that people with higher education would have more positive attitudes towards the otter and its conservation (Rosalino and Rosalino, 2012). For example, in a study about secondary-school students' knowledge of and attitudes toward the Eurasian otter (*Lutra lutra*) and its conservation, results showed that students with greater knowledge had more positive attitudes (Torkar et al., 2010). Although there was no significant correlation between AI and KI values, nor between education and AI, a positive trend was observed. People that have progressed further in school, show attitudes with less variation, indicating a consistence in their opinions towards the otter.

Regarding the attitudes of interviewees, small ponds users revealed to have a more negative attitude towards the otter, when compared to non-users. This can be justified because landowners frequently increase fish stocks at small ponds for their own consumption or for small scale sale. Moreover, these small ponds are usually located in more open areas, when compared to rivers, being easier to spot otters near the water. The simple spotting can be possibly seen as a competition event. That may explain also the pond users' perception of an increase in the number of wild animals using these reservoirs but also sustains the importance of these habitats for fauna especially during dry seasons and drought events.

The obtained distribution map shows an even distribution of the Neotropical otter in the study area, with a regular and continuous presence over the years. This result reveals that the interview method applied to local communities is a very useful tool to access distribution data of species with shy behavior like the Neotropical otter, being the inhabitants of the area more prone to see the species and give precise locations and habitat details.

With the interviews, it was also possible to identify potential environmental threats to otters at local scale. The first is water pollution, caused by agriculture and discharge of domestic effluents, namely that of the "Guarei" prison that is overcrowded and was a very poor water treatment; this was referred by several interviewees and observed during the field campaigns. Another threat is deforestation, with significant destruction of riparian vegetation, mainly for conversion into crop fields. In stretches of the rivers and streams it was possible to observe that it causes loss of refuge places, not only for otters but also for other species that depend from aquatic environments (Rheingantz and Trinca, 2015). Reduction in fish stocks was another mentioned threat, mainly due to the decrease of water quality. For now, this does not seem to be a problem for the otter, mainly because native fish species are being replaced by exotic ones (Tilapia); this however poses a problem for local biodiversity and should be a matter of concern for local conservation entities. Lastly small ponds revealed to be places where otters are seen in the area, a fact that support its role as connectivity elements, especially relevant in the dry season, when they represent water availability and act as important feeding areas mainly when close to watercourses with good refuge conditions (Basto et al., 2011). Although considered sub-optimal habitats, it is therefore important to preserve small ponds, not only for the otter, but also for other species, especially in view of ongoing habitat loss due to the conversion of farmland to eucalyptus plantations, with the consequent increase in evapotranspiration (Lima et al., 2012), drainage of water reservoirs, and severe drought events. For this reason, small ponds may be considered supplementary habitats.

5. Final Remarks

This study demonstrates how a social perspective provides insights about people's knowledge and attitudes towards a potential problematic species, as the Neotropical otter, and that traditional knowledge about animals can be an important asset for changing attitudes and protect conservation-interest species. From the data collected in the present study, we were able to conclude that presently there is a high frequency of interactions between the otter and fishermen, especially in Guareí and Paranapanema rivers. The reported shy behavior of Neotropical otters is not highlighted during some reported interactions, namely when removing the nets after a fishing period. This could be a potential threat to the species, if in the future a shift occurs in the current situation, namely a more professional fishing activity or a drastic reduction in the fish stocks, increasing conflict levels. Coexistence between the otter and locals seems peaceful at the moment, but if the present conditions change, especially the amount of fish in the rivers and the availability of small ponds, some management measures may need to be implemented (e.g., installation of fences around small ponds or landowners' compensation). In the Paranapanema river, some fishermen already freely adopted some proactive actions to minimize encounters, such as avoiding setting their nets near otter dens (Tavares et al., *in press*).

The objectives of the study were accomplished, however some difficulties were felt in the course of the field work, especially during the interviews. Sometimes the communication was difficult, mainly due to language constrains between Brazilian-Portuguese and Original-Portuguese. To overcome this problem and avoid misunderstandings, the questions and answers were repeated whenever necessary. Other limitation was the geographic imprecision of otter sighting locations given by some interviewees. To reduce uncertainty, an approximate distance was asked from the local where the interview was being conducted, and a map was also provided for pinpointing the sighting location so the information could be correctly incorporated in the distribution map.

In the future, some actions should be implemented in order to promote otter conservation both in the region and in other similar areas of Brazil. Monitoring species presence in: 1) potential areas for conflict, 2) human disturbance areas; and 3) optimal areas for otter occurrence such as protected areas, like Angatuba's Ecological Station, is needed in order to compare otter distribution and threat factors evolution and anticipate the need for conservation measures. The Neotropical otter is a "Near Threatened" species with still lacking scientifically sound information. For this reason, it is important to perform educational actions

to widespread the existing information about the species, especially to people that coexist with it. Neotropical otter can also be used like a flagship species, once it is regularly seen by the inhabitants in the study area and is also referred as an attractive and friendly species.

With this in mind, several education actions were already implemented during the project, such as school presentations and participation on local environmental meetings and the production of supplementary material, like a short documentary about the Neotropical otter in the region and an informative record of the species for the students of the “Angatuba” and “Guareí” municipalities. Additionally, the information collected on ongoing otter threats is being conveyed to local public administration (e.g. municipalities, water management entities).

6. References [1]

Akpona, A.H., Djagoun, C.A.M.S., Harrington, L.A., Kabre, A.T., Mensah, G.A., Sinsin, B., 2015. Conflict between spotted-necked otters and fishermen in Hlan River, Benin. J. Nat. Conserv. 27, 63–71.

Alarcon, G.G., Simões-Lopes, P.C., 2003. Preserved Versus Degraded Coastal Environments: A Case Study of the Neotropical Otter in the Environmental Protection Area of Anhatomirim, Southern Brazil. IUCN Otter Spec. Gr. Bull. 20, 6–18.

Alarcon, G.G., Simões-Lopes, P.C., 2004. The Neotropical Otter *Lontra longicaudis* Feeding Habits in a marine costal area, southern Brazil. IUCN Otter Spec. Gr. Bull. 21, 1–6.

Bailey, K.D., 1982. Methods of Social Research, second ed. Macmillan, New York.

Barbieri, F., Machado, R., Zappes, C.A., Oliveira, L.R., 2012. Interactions between the Neotropical otter (*Lontra longicaudis*) and gillnet fishery in the southern Brazilian coast. Ocean Coast. Manag. 63, 16–23.

Basto, M., Pedroso, N., Mira, A., Santos-Reis, M., 2011. Use of small and medium-sized water reservoirs by otters in a Mediterranean ecosystem. Anim. Biol. 61, 75–94.

Bath, A.J., Farmer, L., 2000. Europe's carnivores: a survey of children's attitudes towards wolves, bears and otters. World Wildlife Fund, Godalming, United Kingdom.

Begossi, A., Silva, A.L., Seixas, C.S., de Castro, F., Pezutti, J., Hanazaki, N., Peroni, N., Silvano, R.A.M., 2004. Ecologia de Pescadores da Mata Atlântica e da Amazônia, second ed. RiMa Editora, São Paulo.

Berger, K.M., 2006. Carnivore-Livestock Conflicts: Effects of Subsidized Predator Control and Economic Correlates on the Sheep Industry. Conserv. Biol. 20, 751–761.

Brooks, T.M., Mittermeier, R.A., da Fonseca, G.A.B., Gerlach, J., Hoffmann, M., Lamoreux, J.F., Mittermeier, C.G., Pilgrim, J.D., Rodrigues, A.S.L., 2006. Global Biodiversity Conservation Priorities. Science 313, 58–61.

Carvalho-Junior, O., Macedo-Soares, L.C.P., Birolo, A.B., 2010. Annual and interannual food habits variability of a neotropical otter (*Lontra longicaudis*) population in Conceição Lagoon, south of Brazil. IUCN Otter Spec. Gr. Bull. 27, 24–32.

[1] According to the Journal Biological Conservation

Carvalho-Junior, O., Macedo-Soares, L.C.P., Birolo, A.B., Snyder, T., 2013. A Comparative Diet Analysis of the Neotropical Otter in Santa Catarina Island, Brazil. IUCN Otter Spec. Gr. Bull. 30, 67–77.

Chehebar, C., 1990. Action plan for Latin American otters, in: Foster-Turley, P., Macdonald, S., Mason, C. (Eds.), Otters: An Action Plan for Their Conservation. Chicago Zoological Society, Brookfield, pp. 64–73.

Chehebar, C., 1991. Searching for the giant otter in northeastern Argentina. International Union for the Conservation of Nature. IUCN Otter Spec. Gr. Bull 6, 17–18.

Cheida, C.C., Nakano-Oliveira, E., Fusco-Costa, R., Rocha-Mendes, F., Quadros, J., 2006. Ordem Carnívora, in: Reis, N.R., Peracchi, A.L., Pedro, W.A., Lima, I.P. (Eds.), Mamíferos Do Brasil. Universidade Estadual de Londrina, Londrina, pp. 231–276.

Clarke, K.R., Warwick, R.M., 2001. Change in Marine Communities: An Approach to Statistical Analysis and Interpretation, second ed. Plymouth Marine Laboratory, Plymouth, U.K.

Clarke, R.N., Gorley, K.R., 2006. Primer version 6: User Manual/Tutorial. Plymouth Marine Laboratory, Plymouth, U.K.

Crooks, K.R., 2002. Relative sensitivities of mammalian carnivores to habitat fragmentation. Conserv. Biol. 16, 488–502.

De Castro, F.R., Stutz-Reis, S., Reis, S.S., Nakano-Oliveira, E., Andriolo, A., 2014. Fishermen's perception of Neotropical otters (*Lontra longicaudis*) and their attacks on artisanal fixed fence traps: The case of caiçara communities. Ocean Coast. Manag. 92, 19–27.

Dell Inc., 2015. Dell Statistica (data analysis software system). Version 13. Available on internet at software.dell.com.

Diamond, J., 2001. Armas, Germes e Aço - Os Destinos das Sociedades Humanas, first ed. Record, Rio de Janeiro.

Diamond, J., 2005. Colapso: como as sociedades escolhem o fracasso ou o sucesso, first ed. Editora RCB, Rio de Janeiro.

Duplaix, N., 2004. Guyana Giant Otter Project, 2002-2004 Research Results. Oceanic Society Expeditions, California.

Eisenberg, J.F., Redford, K.H., 1999. Mammals of the Neotropics: The Central Neotropics, first ed. University of Chicago Press, Chicago.

Freitas, D., Gomes, J., Luis, T.S., Madruga, L., Marques, C., Baptista, G., Rosalino, L.M., Antunes, P., Santos, R., Santos-Reis, M., 2007. Otters and fish farms in the Sado estuary: Ecological and socio-economic basis of a conflict. Hydrobiologia 587, 51–62.

Gallo, J.P., 1986. Otters in Mexico. J. Otter Trust 1, 19–24.

Gallo-Reynoso, J.P., 1997. Situación y distrubicion de las nutrias en Mexico, con énfasis en *Lontra longicaudis annectens* Major 1897. Rev. Mex. Mast. 2, 10-32.

González, I., Utrera, A., 2004. Distribution of the Neotropical otter *Lontra longicaudis* in the venezuelian Andes: Habitat and status of its population. IUCN Otter Spec. Gr. Bull. 18, 1–5.

Graham, K., Beckerman, A., Thirgood, S., 2005. Human-predator-prey conflicts: ecological correlates, prey losses and patterns of management. Biol. Conserv. 122, 159–171.

Henry, R., 2012. O diagnóstico da qualidade das águas do rio Guareí (Angatuba, SP): uma cooperação ensino superior – educação básica, first ed. FUNDIBIO, Botucatu.

Hill, M.M., Hill, A., 2000. Investigação por Questionário, first ed. Edições Sílabo, Lisboa.

Huntington, H.P., 2000. Using Traditional Ecological Knowledge in Science: Methods and Applications. Ecol. Appl. 10, 1270–1274.

Hyman, M.R., Sierra, J.J., 2010. Marketing Research Kit for Dummies, first ed. Wiley Publishing, Inc, Indianapolis.

IBAMA, 2001. Mamíferos aquáticos do Brasil: Plano de Ação – versão II, second ed. IBAMA, Brasilia.

IBM, 2013. IBM SPSS Statistics for Windows. IBM Corp. Available on internet at http://www.ibm.com/analytics/us/en/technology/spss/

Kloskowski, J., 2005. Otter *Lutra lutra* damage at farmed fisheries in southeastern Poland, I: an interview survey. Wildlife Biol. 11, 201–206.

Kloskowski, J., 2011. Human-wildlife conflicts at pond fisheries in eastern Poland: Perceptions and management of wildlife damage. Eur. J. Wildl. Res. 57, 295–304.

Kranz, A., 2000. Otters (*Lutra lutra*) increasing in Central Europe: from the threat of extinction to locally perceived overpopulation? Mammalia 64, 357–368.

Kranz, A., Toman, A., 2004. Expedition Report 2004/2 on the Status and Ecology of the European Mink (*Mustela lutreola*) in the Danube Delta Andreas. *M. Lutreola* – Exped. Rep. 2004/2.

Larivière, S., 1999. *Lontra longicaudis*. Mamm. Species 609, 1–5.

Legendre, P., Legendre, L., 1998. Numerical ecology, second ed. Elsevier, Amesterdam.

Likert, R., 1932. A technique for the measurement of attitudes. Arch. Psychol. 140, 1–55.

Lima, W.D.P., Laprovitera, R., de Barros Ferraz, S.F., Rodrigues, C.B., Silva, M.M., 2012. Forest Plantations and Water Consumption: A Strategy for Hydrosolidarity. Int. J. For. Res. 2012, 1–8.

Lima, D.S., Marmontel, M., Bernard, E., 2014. Conflicts between humans and giant otters (*Pteronura brasiliensis*) in Amanã Reserve, Brazilian Amazonia. Ambient. Soc. 17, 127–142.

Lisboa, M.A.M., 2008. A Política dos Coronéis e a Difusão do Ensino Primário em Angatuba/SP. Universidade Estadual de Campinas - UNICAMP.

Marques, J.G., 2001. Pescando pescadores: ciência e etnociência em uma perspectiva ecológica, second ed. NUPAUB e USP, São Paulo.

Matos, H.M., Santos, M.J., Palomares, F., Santos-Reis, M., 2008. Does riparian habitat condition influence mammalian carnivore abundance in Mediterranean ecosystems? Biodivers. Conserv. 18, 373–386.

Melendres, A.P., 1978. Notas sobre las nutrias del Río del Ecuador, in: Duplaix, N. (Ed.), Otters: Proceedings of the First Working Meeting of the Otter Specialist Group. International Union for Conservation of Nature and Natural Resources, Morges, Switzerland, pp. 56–66.

Metzger, J.P., Lewinsohn, T.M., Joly, C.A., Verdade, L.M., Martinelli, L.A., Rodrigues, R.R., 2010. Brazilian Law: Full Speed in Reverse? Science 329, 276–278.

Michalski, F., Conceição, P.C., Amador, J.A., Laufer, J., Norris, D., 2012. Local Perceptions and Implications for Giant Otter (*Pteronura brasiliensis*) Conservation around Protected Areas in the Eastern Brazilian Amazon. IUCN Otter Spec. Gr. Bull. 29, 34– 45.

Micheli, F., Polis, G.A., Boersma, P.D., Hixon, M.A., Norse, E.A., Snelgrove, P.V.R., Soulé, M.E., 2001. Human alteration of food webs: research priorities for conservation and management, in: Soulé, M., Orians, G.H. (Eds.), Conservation Biology: Research Priorities for the next Decade. Island Press, Washington DC, pp. 31–58.

Noether, G.E., 1981. Why Kendall Tau. Teach. Stat. 3, 41–43.

Nunnally, J.C., 1978. Psychometric theory, second ed. McGraw-Hill, New York.

Pardini, R., 1998. Feeding ecology of the neotropical river otter *Lontra longicaudis* in an Atlantic Forest stream, south-eastern Brazil. J. Zool. 245, 385–391.

Pardini, R., Trajano, E., 1999. Use of Shelters by the Neotropical River Otter (*Lontra longicaudis*) in an Atlantic Forest Stream, Southeastern Brazil. J. Mammal. 80, 600–610.

Pedroso, N.M., Marques, T.A., Santos-Reis, M., 2014. The response of otters to environmental changes imposed by the construction of large dams. Aquat. Conserv. Mar. Freshw. Ecosyst. 24, 66–80.

Peel, M.C., Finlayson, B.L., McMahon, T.A., 2007. Updated world map of the Köppen-Geiger climate classification. Hydrol. Earth Syst. Sci. 11, 1633–1644.

Pita, C., Pierce, G.J., Theodossiou, I., Macpherson, K., 2011. An overview of commercial fishers' attitudes towards marine protected areas. Hydrobiologia 670, 289–306.

Poledníková, K., Větrovcová, J., Poledník, L., Hlaváč, V., 2010. Carbofuran - a new and effective method of illegal killing of otters (*Lutra lutra*) in the Czech Republic. IUCN Otter Spec. Gr. Bull. 27, 137–146.

Pont, A.C., Marchini, S., Engel, M.T., Machado, R., Ott, P.H., Crespo, E.A., Coscarella, M., Dalzochio, M.S., de Oliveira, L.R., 2015. The human dimension of the conflict between fishermen and South American sea lions in southern Brazil. Hydrobiologia 770, 89–104.

Quadros, J., Monteiro-Filho, E.L.A., 2001. Diet of the neotropical otter, *Lontra longicaudis*, in an Atlantic forest area, Santa Catarina state, southern Brazil. Stud. Neotrop. Fauna Environ. 36, 15–21.

Quantum GIS Development Team, 2016. Quantum GIS Geographic Information System. Open Source Geospatial Foundation Project. Available on internet at http://qgis.osgeo.org.

Rheingantz, M.L., Waldemarin, H.F., Rodrigues, L., Moulton, T.P., 2011. Seasonal and spatial differences in feeding habits of the Neotropical otter *Lontra longicaudis* (Carnivora: Mustelidae) in a coastal catchment of southeastern Brazil. Zoologia 28, 37–44.

Rheingantz, M.L., Trinca, C.S., 2015. *Lontra longicaudis*. The IUCN Red List of Threatened Species Version 2016.1. Available on internet at http://www.iucnredlist.org/details/12304/0. (assessed on 15.05.2016).

Rheingantz, M.L., Leuchtenberger, C., Zucco, C.A., Fernandez, F.A.S., 2016. Differences in activity patterns of the Neotropical otter *Lontra longicaudis* between rivers of two Brazilian ecoregions. J. Trop. Ecol. 32, 170–174.

Rodrigues, L.D.A., Leuchtenberger, C., Kasper, C.B., Junior, O.C., Silva, V.C.F., 2013. Avaliação do risco de extinção da lontra neotropical *Lontra longicaudis* (Olfers, 1818) no Brasil. Biodiversidade Bras.

Rosalino, L.M., Rosalino, C., 2012. Nature conservation from a Junior High School perspective. J. Nat. Conserv. 20, 153–161.

Rosas-Ribeiro, P.F., Rosas, F.C.W., Zuanon, J., 2012. Conflict between Fishermen and Giant Otters *Pteronura brasiliensis* in Western Brazilian Amazon. Biotropica 44, 437–444.

Scott, D.W., 2009. Sturges' rule. Wiley Interdiscip. Rev. Comput. Stat. 1, 303–306.

Secretaria do Meio Ambiente / Instituto Florestal, 2009. Plano de Manejo Estação Ecológica de Angatuba. Páginas & Letras - Editora Gráfica Limitada, São Paulo.

Tavares, J.L., Lacorte, M.C., Pedroso, N.M., Rosalino, L.M., Verdade, L.M., *in press*. Neotropical otters in human-altered environments: diet, dens and fishermen perceptions, in: San, E.D.L., Sato, J.J., Belant, J.L., Somers, M.J. (Eds.), Small Carnivores: Evolution, Ecology, Behaviour and Conservation. Wiley-Blackwell, Oxford.

Thirgood, S.J., Redpath, S.M., Haydon, D.T., Rothery, P., Newton, I., Hudson, P.J., 2000. Habitat loss and raptor predation: disentangling long- and short-term causes of red grouse declines. Proc. Biol. Sci. 267, 651–656.

Tockner, K., Stanford, J.A., 2002. Riverine flood plains: present state and future trends. Environ. Conserv. 29, 308–330.

Torkar, G., Mohar, P., Gregorc, T., Nekrep, I., Adamič, M.H., 2010. The conservation knowledge and attitudes of teenagers in Slovenia toward the Eurasian Otter. Int. J. Environ. Sci. Educ. 5, 341–352.

Treves, A., Karanth, K.U., 2003. Human-Carnivore Conflict and Perspectives on Carnivore Management Worldwide. Conserv. Biol. 17, 1491–1499.

Václavíková, M., Václavík, T., Kostkan, V., 2011. Otters vs. fishermen: Stakeholders' perceptions of otter predation and damage compensation in the Czech Republic. J. Nat. Conserv. 19, 95–102.

Verdade, L.M., Rosalino, L.M., Gheler-Costa, C., Pedroso, N.M., Lyra-Jorge, M.C., 2011. Adaptation of Mesocarnivores (Mammalia: Carnivora) to Agricultural Landscapes in Mediterranean Europe and Southeastern Brazil: A Trophic Perspective, in: Rosalino, L.M.,

Gheler-Costa, C. (Eds.), Middle-Sized Carnivores in Agricultural Landscapes. Nova Science Publishers, Inc., pp. 1–38.

Vié, J.C., Hilton-Taylor, C., Stuart, S.N., 2009. Wildlife in a Changing World – An Analysis of the 2008 IUCN Red List of Threatened Species. IUCN, Gland - Switzerland.

Woodroffe, R., 2000. Predators and people: using human densities to interpret declines of large carnivores. Anim. Conserv. 3, 165–173.

Zappes, C.A., Andriolo, A., Silva, F.O., Monteiro-Filho, E.L. de A., 2009. Potencial conflicts between fishermen and *Sotalia guianensis* (Van Bénéden, 1864) (Cetacea, Delphinidae) in Brazil. Sitientibus Série Ciências Biol. 9, 208–214.

Annex

Annex I: The questionnaire used in this study, in its original form.

Parte I – Características do inquirido

Sexo: F___ M___

Idade: _____

Ocupação: _____

Escolaridade: _____

Há quanto tempo você/o senhor mora ou trabalha por aqui? _____
(E o seu trabalho anterior também era aqui na região?)

Nº de açudes da fazenda: _____

Ponto GPS e nome do local: _____

Parte II – Conhecimentos e perceções acerca da lontra

1. Você/o senhor alguma vez já ouviu falar de um animal chamado lontra ou "lontrinha"? (pedir descrição e só depois mostrar foto)
   a) Sim__
   b) Não__

2. Você/o senhor já viu este animal alguma vez?
   a) Sim__ Quando e onde? _____
   b) Não__

3. Você/o senhor costuma ver a lontra por aqui? Quantas vezes por semana ou por mês?
   a) > 1 vez por semana__
   b) Até 1 vez por semana__
   c) Até 1 vez por mês__
   d) < 1 vez por mês__
   e) Nunca/Não me lembro__

4. Em que horário você/o senhor costuma ver mais o animal? De dia ou de noite?

a) Durante o dia __
b) Durante a noite __
c) Não sabe __

5. Você/o senhor alguma vez já viu este animal em outro lugar mais distante? Já ouviu alguma pessoa que mora mais longe falar dele?

a) Sim__ Onde e quando? _____
b) Não __

6. Você/o senhor sabe o que a lontra costuma comer?

a) Peixe __
b) Carne __
c) Plantas __
d) Insetos __
e) Outros __
f) Não sabe __

7. Sabe onde que ela mora?

a) Floresta__
b) Margens do rio__
c) Rio__
d) Áreas agrícolas__
e) Açudes__
f) Outros__
g) Não sabe__

8. O que você/o senhor acha que aconteceu com a quantidade de lontras que tem por aqui? Parece que nos últimos anos aumentou, diminuiu ou está igual antes?

a) A aumentar__
b) Estável__
c) A diminuir__
d) Não sabe__

9. Você/o senhor acha que o governo faz alguma coisa para cuidar das lontras e evitar que elas sejam mortas (proteger a lontra)?

a) Sim__
b) Não__
c) Não sabe__

Parte III – Interações com a lontra

1. Você/o senhor acha que a lontra alguma vez interferiu no seu trabalho aqui? (Você sabe se a lontra já atrapalhou o seu trabalho aqui?)

a) Sim__ Quais, quando e como? _____

b) Não__

2. E na propriedade dos vizinhos? Você/o senhor sabe se a lontra já interferiu no trabalho de lá?

a) Sim__ Quais, quando e como? _____

b) Não__

3. Agora vou dizer agora umas frases, e você/o senhor vai-me dizer se concorda, discorda ou se nem concorda nem discorda com elas:

Afirmação	**1 Discordo completa-mente**	**2 Discordo**	**3 Nem concordo nem discordo**	**4 Concordo**	**5 Concordo completa-mente**
A lontra é um bicho que traz problemas aos habitantes da área					
A lontra deve ser mantida por aqui por fazer parte da região					
As pessoas não devem tratar mal a lontra, pois ela é um bicho característico daqui					
A lontra é um animal do qual as pessoas gostam					
A lontra deve ser protegida pelo governo para impedir que ela desapareça					
Mesmo que a lontra atrapalhe as pessoas, ela não deve ser maltratada por elas					
As pessoas não gostam da lontra					

Parte IV – Sobre o habitat da lontra

4. Em quais atividades do seu dia-a-dia você/o senhor usa água dos açudes ou do Rio Guareí?

a) Regar a plantação__

b) Pesca__

c) Criação de gado/boi__

d) Uso doméstico (banhos, louça, etc…) __

e) Consumo próprio (beber) __

f) Nada__
g) Outras, quais? _____

5. O que você/o senhor acha da qualidade da água do rio Guareí?
a) Muito boa__
b) Boa__
c) Razoável__
d) Má__
e) Péssima__
f) Não sei__

6. E da água do açude? O que você/o senhor acha da qualidade?
a) Muito boa__
b) Boa__
c) Razoável__
d) Má__
e) Péssima__
f) Não sei__

7. Você acha/o senhor que a qualidade da água do rio Guareí mudou com o passar do tempo? Está melhor, pior ou igual?
a) Melhor__
b) Pior__
c) Igual__
d) Não sabe__

8. E a água dos açudes? Está melhor, pior ou igual?
a) Melhor__
b) Pior__
c) Igual__
d) Não sabe__

9. As atividades da fazenda mudaram com o passar dos anos? O tipo de produção mudou?
a) Sim__ Quais? _____
b) Não__
c) Não sabe__

10. Atualmente, quais são os peixes que existem em maior quantidade ou que você/o senhor costuma pescar mais no rio Guareí?

_____
_____

11. Os tipos de peixe têm aumentado no rio Guareí ou não? Ou estão iguais?

a) Mais tipos de peixe__
b) Iguais tipos de peixe__
c) Menos tipos de peixes __
d) Não sabe__

12. E a quantidade do peixe, tem aumentado ou não no rio Guareí? Ou está igual?

a) Maior quantidade de peixe__
b) Igual quantidade de peixe__
c) Menos quantidade de peixe__
d) Não sabe__

13. Neste momento, a região está passando por um período de falta de chuvas?

a) Sim__
b) Não__
c) Não sei__

14. Quando acontece, como é que a falta de chuva afeta as atividades desenvolvidas na fazenda?

_____
_____
_____

15. Como a falta de chuva afeta os açudes e o rio Guareí?

a) Aumenta a quantidade de água, diminuindo a qualidade da água__
b) Aumenta a quantidade de água, não alterando a qualidade da água__
c) Aumenta a quantidade de água, aumentando a qualidade da água__
d) Não altera a quantidade de água, diminuindo a qualidade da água __
e) Não altera a quantidade de água, não alterando a qualidade da água __
f) Não altera a quantidade de água, aumentando a qualidade da água __
g) Não afeta__
h) Diminui a quantidade de água, diminuindo a qualidade da água __
i) Diminui a quantidade de água, não alterando a qualidade da água __
j) Diminui a quantidade de água, aumentando a qualidade da água __
k) Não sabe__

16. E você/o senhor acha que a seca afeta a lontra de alguma maneira? Como?

_____

_____

17. Sobre os animais e as aves que existem nas margens do rio Guareí, você/o senhor acha que hoje tem mais, tem menos ou tem a mesma quantidade de antes?

a) Aumento do número de animais__
b) Mantêm-se o número de animais__
c) Diminuição do número de animais__
d) Não sabe__

18. E a vegetação à beira do rio? Aumentou a quantidade, diminuiu ou está igual?

a) Aumentado a sua área__
b) Mantém-se igual__
c) Diminuiu a sua área__
d) Não sabe__

19. Você/o senhor percebeu se existem plantas e animais diferentes, que não existiam antes, nas margens do rio Guareí?

a) Sim__ Quais? _____
b) Não__
c) Não sabe__

20. Você/o senhor acha que as pessoas estão preocupadas em preservar e cuidar do rio Guareí e da vegetação ao redor dele?

a) Sim__ De que forma? _____
b) Não__ Porquê? _____
c) Não sabe__

21. E o governo, você/o senhor acha que ele está preocupado com a pesca, com os animais e as plantas do rio Guareí?

a) Sim__ De que forma? _____
b) Não__ Porquê? _____
c) Não sabe__

Se a pessoa estiver disposta a fornecer:

Nome: _____

Contato: _____